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ABSTRACT

This paper discusses the merits of developing a high school semester time-table, or schedule, as the final planning stage in the educational process. Such a schedule would provide a weekly breakdown list of all academic subjects, grade levels, teachers for each subject and grade, rooms, laboratories and other facilities, and resources, thereby coordinating the different educational and managerial aspects of the semester. It is noted that several different schedules may be designed by using a problem-solving computer program and translating the weekly breakdown list into numerical values. The priority given each value then decides the parameters of the semester schedule. It is argued that successful planning and operation of a semester schedule would result in a substantial increase in the quality of education. (DB)

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OPTIMISATION OF THE PLANNING OF THE HIGHER SCHOOL EDUCATIONAL PROCESS THROUGH MANAGING THE QUALITY OF THE TERM SCHEDULE

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OPTIMISATION OF THE PLANNING OF THE HIGHER SCHOOL EDUCATIONAL PROCESS THROUGH MANAGING THE QUALITY OF THE TERM SCHEDULE

S.I.Buchvarov, I.P.Ganashev

The working out of the term schedule in the Higher Schools is the final stage of the planning of the educational process.

All the various possibilities which an optimally effective time-table aiming at a good training of highly qualitied specialists can give as well as a fair allocation of the time for individual work of the students can be realised only through an education schedule following certain requirements. It should be worked out for each term if we want to have a full picture of the relations and their effect where the separate subjects are concerned. If the schedule does not meet these requirements it cannot be an optimally effective one.

The time-table regulates the work of the students and the school as a complete system. It allocates the different subjects in time and place, connecting the separate periods with the resources necessary for their realisation. The conformity so achieved, including all education groups, we define as the kernel of the schedule. That is why the kernel of the schedule if it is worked out effectively should not be changed during the term because it reduces the quality of the education.

According to [1] and [2] the optimisation of the planning of the educational process should be carried out in conformity with the needs of the students and not of the teachers. Among the main requirements are the rhythm and the methodological consistency in the educational information. Some Higher Schools solve the problem by the so called "reiteration week" schedule. It is easy to be worked out and convenient for the teachers because of the rhythm. But it is this very rhythm which is not in favour of the students because the different parts of a subject are not equally difficult and while in some lessons the teacher should give information, sometimes sort out what is necessary and what not, in others he is obliged to saturate his classes with somewhat unimportant data in order to "fill in" the allocated periods.

That is why we think that the so called "unique week" Term Schedule is the optimally effective planning for the Higher Schools. It makes possible the realisation of all didactic requirements of the education process, of the interrelation of the subjects within the term, ensures a precise planning of the work throughout the term for students and teachers alike.

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In order to make the working out of the schedule easier it is recommended to make out a week chart of the educational process for the different subjects. It is worked out for each education group and is a kind of flexible education calendar for all subjects included in the term schedule. This chart is designed according to the structural-logical scheme of the qualifications of the specialists. The time allocated for studying of a given subject is distributed throughout all weeks of the term. It gives the possibility to see the mutual realization in terms of time between the subjects during the term in a single document. The chart is flexible so that it is not difficult to regulate the steady education of the students in terms of lectures tutorials, laboratory work, discussions, testing, etc.

The working out of the schedule begins with some managerial and planning activities, which can be divided into two groups:

1. Activities which are common for all Higher Schools for a given period of time.
2. Activities which can be chosen from among several possibilities aiming at optimal effectiveness.

To group 1. we can attribute the following activities:

- instalment of all necessary education equipment;
- employment of teachers'staff;
- definining of the organisational structure of the Higher School;
- specifying of the actual contents of teaching plans and time-tables;
- specifying the compulsory preliminary usage of the resources;

To group 2. we can attribute the following activities:

- planning of the educational process - structure of streaming, diagram of the beginning and the end of the term for each school year, group and each school subject, diagram of joint activities through the term;
- distribution of the teaching-groups among the teachers for all subjects of the teaching'plans;
- specifying the volume and the time of the relative preliminary usage of the resources;
- working out of a system of priority of education groups and subjects in the process of planning.

The information achieved as a result of these process is introduced into data and it is used as the basis of the culculation process for working out of the Term Schedule.

It is proved that the task of working out the Term Schedule is NP-complete. Therefor no way of solving it in a deductive way for a reasonable time is known. The main approach to it in complianse with [3], [4], [5], [6], [7] is the euristic programming. In forming of

euristics decisions role for controlling of creative algorithms have the values of the input data structure. Taking into consideration the above said, i.e. the fact that part of the input information is based on preliminary decisions which can vary in a certain sphere of possible values we talk of management of the quality of the Term Schedule.

The management of the quality of the Term Schedule is an iterational process, the parametres of which are the above mentioned decisions, organisational and planning, which are not simply determined. Having at hand sufficiently powerful calculating system and an euristic programme solving a problem in time corresponding to the chart of the organisation of the education process, several varieties for designing of the possible values of the above mentioned parametres, can be worked out. Each of these variations is assessed with the help of a criterion, formulated in the following way:

$$(1) \qquad \tau = 1 - \frac{1}{F} \sum_{c=1}^{F} \left(\frac{1}{N_c} \sum_{i=1}^{3} \left(\sum_{i=1}^{D_1} \delta_1 d_{i1} + \sum_{j=1}^{M_1} \mu_1 m_{j1} + \sum_{k=1}^{S_1} \sigma_1 s_{k1} \right) \right),$$

where:

F -is the number of the weeks in the term;

N_c - is the number of the classes planned for the week;

$D_1, 1 = 1,2,3$ - is the number of the basic essential and less important organisational requirements in the working out of the Term Schedule;

$M_1, 1 = 1,2,3$ - is the number of the basic essential and less important methodological requirements in the working out of the Term Schedule.

$S_1, 1=1,2,3$ - is the number of the basic essential and less important requirements connected with the guarantee of the individual work of the students in the working out of the Term Schedule;

δ_1 , μ_1, σ_1, $1=1,2,3$ - are the coefficients of the level of the inefficiency of the classes as a result of the failure to fulfill the organisational and methodological requirements or the requirements connected with the guarantee of the individual work of the students.

$$d_{i,1} , \; i = 1, \ldots, D_1, \; 1 = 1, 2, 3 \in \langle 0,1 \rangle$$

$$m_{j,1} , \; i = 1, \ldots, M_1, \; 1 = 1, 2, 3 \in \langle 0,1 \rangle$$

$$S_{k,1} , \; k = 1, \ldots, S_1, \; 1 = 1, 2, 3 \in \langle 0,1 \rangle$$

are variables, stating the fulfillment or the failure to ful fill the stated organisational and methodological requirements respectively, or the requirements connected whith the guarantee of the individual work of the students. They are 0 when tbe requirement is fulfilled and 1 if it is not.

The criterion τ expresses the quality of the Term Schedule.

There are several approaches to the problem:

- euristic variation of a given parameter from the initial terms in discreet values;
- euristic deviation of a group of parameters from the initial terms in discreet values;
- deviation of one parameter or a group of parameters in an interval of possible values through choosing of concrete value in the process of the very planning.

The following strategy is accepted as a working variant for authomated working out of the Term Schedule:

- parameters of the quality of the Term Schedule which are examined separately are the distribution of the classes among the teachers and the preliminary relative usage of the resources;
- parameters of the quality of the Term Schedule which are examined in groups are the system of the priorities (of the students'classes and the subjects) together with the diagram of the flow of the subjects; these groups of parameters are combined with the seperate values of the allocation of the periods and the preliminary relative usage of the resources;
- parameters of the quality of the Term Schedule which are examined in intervals of possible values are the priorities of the students' groups and the subjects.

It is proved that the assessment of the quality of the Term Schedule weekly, described above, is possible, applicable and effective.

The methodology of managment of the quality of the Term Schedule gives good results enlarging τ in 3 to 5 iterations from 0,7 to 0,91. τ is computed by (1), where F=20, N_c =2160 and

$$\sum_{j=1}^{3} D_j + \sum_{j=1}^{3} M_j + \sum_{j=1}^{3} S_j \approx 200$$

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